Industrial and Technology Education Teacher Preparation in California: Standards of Quality and Effectiveness for Subject Matter Programs

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A Handbook for
Teacher Educators
&
Program Reviewers

2006

California Commission on Teacher Credentialing

Arnold Schwarzenegger, Governor
State of California

2006

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Teacher Subject Matter Advisory Panel

California Commission on Teacher Credentialing
2004-2006

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Industrial and Technology Education Standards of Quality and Effectiveness for Subject Matter Preparation Programs

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Foreword

One of the purposes of education is to enable students to learn the important subjects of the school curriculum so they can further their professional goals and function effectively in work, society and family life. Each year in California, hundreds of students enroll in industrial and technology education classes with teachers who are certified by the Commission on Teacher Credentialing (CTC) to teach those classes in public schools. The extent to which students learn to engage in and utilize industrial and technology education depends substantially on the preparation of their teachers in industrial and technology education and the quality of the teaching of industrial and technology classes.

The Commission is the agency of California government that licenses teachers and other professionals who serve in the public schools. As the policymaking body that establishes and maintains standards for the education profession in the state, the Commission is concerned with the quality and effectiveness of the preparation of teachers and other school practitioners. On behalf of the education profession and the general public, the Commission has an important responsibility to establish and implement strong, effective standards of quality for the preparation and assessment of credential candidates.

California teacher candidates are required to demonstrate competence in the subject matter they will be authorized to teach. Candidates for the Single Subject Teaching Credential have two options available for satisfying this requirement: they can either complete a Commission-approved subject matter preparation program, or they can pass the appropriate Commission-adopted subject matter examination(s) (Education Code sections 44280 and 44310). Because they satisfy the same requirement, these two options are to be as aligned and congruent as possible.

However, the substance and relevance of the single subject matter program standards and the validity of examination specifications (i.e., subject matter requirements) is not permanent. The periodic reconsideration of subject matter program standards and the need for periodic examination validity studies are related directly to one of the Commission's fundamental missions: to provide a strong assurance that teaching credentials issued by the Commission are awarded to individuals who have the knowledge, skills, and abilities that are needed in order to succeed in public school teaching positions in California. Best professional practice related to the program standards and the legal defensibility of the examination specifications require that the standards and specifications be periodically reviewed and rewritten, as job requirements and expectations change over time (Education Code sections 44225i, j, 44257, and 44288).

In the mid-1990s, the Commission developed and adopted standards for single subject matter preparation programs and, at the same time, specifications for the single subject matter examinations. This work was based on the advice of subject matter advisory panels and data from validity studies, and resulted in program standards and examination specifications that were valid and closely aligned with each other. Those subject matter standards and specifications were adopted by the Commission in 1998 and are still in use today. They are now being replaced by the subject matter requirements and single subject matter standards adopted by the Commission in 2006, as presented in this handbook.

The Commission's responsibility for establishing high standards for teachers is based, in part, on three major pieces of legislation. In 1988, 1992 and 1998 the Legislature and the governor enacted legislation sponsored by the Commission that strengthened the professional role of the Commission and enhanced its authority to establish rigorous standards for the preparation and assessment of prospective teachers. These reform laws were Senate Bills 148 (Chapter 1355, Stats. 1988), 1422 (Chapter 1245, Stats. 1992) and 2042 (Chap. 548, Stats.1998). As a result, the Commission has taken on new responsibilities for establishing and maintaining rigorous levels of quality in teacher preparation and competency for beginning teachers. To implement these three statutes, the CTC has developed new standards, subject matter requirements and other policies collaboratively with representatives of postsecondary institutions, teachers and administrators in public schools, and statewide leaders involved in public education. This work was done in alignment with the State Board-adopted academic content standards and/or frameworks for K-12 students, and, as required by SB 2042 (Chap. 548, Stats.1998), the K-12 student academic content standards are reflected in the Commission's teacher preparation and subject matter preparation program standards.

The revision of Commission standards pursuant to SB 2042 (Chap. 548, Stats.1998) was undertaken in three phases. Single subject matter advisory panels were established to assist in this important work. The first two phases of single subject matter advisory panels addressed the content areas of English, mathematics, science, social science, art, music, languages other than English, and physical education. These panels completed their work over a two year period from 2001-2003. The third and final phase of single subject matter panels was accomplished in 2004, and addressed the subject areas of agriculture, business, health science, home economics, industrial and technology education, and languages other than English: American Sign Language. The new subject matter standards developed by all of the panels were grounded in and aligned with the academic content standards for California K-12 students.

Part 1: Introduction to Subject Matter Program Standards

A. The Commission's Responsibility for Program Standards

The Commission fulfills one of its responsibilities to the public and to the profession by developing, adopting and implementing standards of program quality and effectiveness. In the process of upholding high standards for the preparation of teachers, the Commission also respects the considered judgments of educational institutions and professional educators, and holds educators accountable for excellence. The premises and principles outlined below reflect the Commission's approach to fulfilling its responsibilities under the law. The Commission asked the single subject advisory panels to apply these general principles to the development of standards for single subject matter programs.

1) *The status of teacher preparation programs in colleges and universities should be determined on the basis of standards that relate to significant aspects of the quality of those programs.*
2) *There are many ways in which a teacher preparation program could be excellent.*
3) *The curriculum of teacher preparation plays a central role in a program's quality.*
4) *Teacher preparation programs should prepare candidates to teach the public school curriculum effectively.*
5) *In California's public schools, the student population is so diverse that the preparation of educators to teach culturally diverse students cannot be the exclusive responsibility of professional preparation programs in schools of education.*
6) *The curriculum of a teacher preparation program should be based on an explicit statement of purpose and philosophy. An excellent program also includes student services and policies such as advisement services and admission criteria.*
7) *The assessment of each student's attainments in a teacher preparation program is a significant responsibility of the institution that offers the program.*
8) *The Commission's standards of program quality allow quality to assume different forms in different environments.*
9) *The Commission's standards of program quality are roughly equivalent in breadth and importance.*
10) *Whether a particular program fulfills the Commission's standards is a judgment that is made by professionals who have been trained in interpreting the standards.*

1. Overview of Standards for Preliminary Teacher Preparation Programs

The standards reforms initiated by SB 2042 (Chap. 548, Stats. 1998) began with the simultaneous development of standards for preliminary teacher preparation programs and for teacher induction programs. The advisory panel appointed by the Commission that developed these two sets of standards was charged with developing the following three policy documents for review and consideration by the Commission:

- New standards of quality and effectiveness for preliminary teacher preparation programs;
- Teaching Performance Expectations that would serve as the basis for evaluating the competence of teacher candidates on teaching performance assessments embedded in preparation programs; and
- New standards of quality and effectiveness for professional teacher induction programs.

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Following their adoption by the Commission in 2001, these three sets of standards initiated structural changes in the teacher credentialing system, as follows:

- alignment of all teacher preparation standards with the state-adopted academic content standards and performance levels for K-12 students, and with the *California Standards for the Teaching Profession (CSTP)*;
- inclusion of a teaching performance assessment in preliminary multiple and single subject teacher preparation programs; and
- a required induction period of support and formative assessment for all first and second year multiple and single subject teachers.

In addition to these structural and thematic shifts in the Commission's credentialing system and standards, SB 2042 (Chap. 548, Stats. 1998) replaced the Professional Clear Credential course requirements in health, mainstreaming and technology with a requirement that essential preparation in these three areas be addressed in both the preparation and the induction standards. Follow-up legislation in 1999, AB 1059 (Chap. 711, Stats. 1999) required that new standards for preparation and induction programs include preparation for all teachers to teach English learners in mainstream classrooms. The subject matter standards in this handbook have been designed to complement the SB 2042 standards for programs of pedagogical preparation.

2. Standards for Subject Matter Preparation Programs for Prospective Teachers

In California, subject matter preparation programs for prospective teachers are not the same as undergraduate degree programs. Postsecondary institutions govern academic programs that lead to the awarding of degrees, including baccalaureate degrees in Industrial and Technology, whereas the Commission sets standards for academic programs that lead to the issuance of credentials, including the Single Subject Teaching Credential in Industrial and Technology. An applicant for a teaching credential must have earned a Bachelor's degree from an accredited institution, but the degree may be in a subject other than the one to appear on the credential. Similarly, degree programs for undergraduate students in Industrial and Technology may or may not fulfill the Commission's standards for subject matter preparation. Single subject candidates who complete an approved subject matter program that satisfies the standards meet the subject matter requirement to qualify for the Single Subject Credential in Industrial and Technology.

3. The Standards Development Process

The Commission's process for standards development includes the establishment of advisory panels that develop and recommend program standards to the Commission. As this process was applied to the development of subject matter program standards, each panel consisted of:

- Classroom teachers of the subject area
- Subject area specialists in school districts, county offices of education, and postsecondary institutions
- Professors in the subject area teaching in subject matter preparation programs
- Teacher educators
- Members of relevant professional organizations
- Members of other relevant committees and advisory panels
- A liaison from the California Department of Education.

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During the third phase of standards development, twelve panel members were appointed to the Agriculture Panel; twelve members were appointed to the Languages Other than English: American Sign Language Panel; eighteen members were appointed to the Business Panel; thirteen members were appointed to the Health Science Panel; fourteen members were appointed to the Home Economics Panel; and fourteen members were appointed to the Industrial and Technology Education Panel. These panels began their work in 2004 with a written charge that described their responsibilities for identifying the subject-specific knowledge, skills, and abilities (SMRs) which form the basis of the content required in Commission-approved subject matter preparation programs for teacher candidates. The SMRs for each of these content areas were approved by the Commission at its January 2005 meeting.

a. Essential Reference Documents for Subject Matter Panels

The subject matter panels used a number of documents as primary resource references for their work. The documents listed below were essential for the phase three panels' use in developing the draft program standards that were subsequently adopted by the Commission.

- The draft academic content standards for K-12 students and/or frameworks approved by the California State Board of Education (2005)

- The Commission-approved (1996) *Standards of Quality and Effectiveness for Subject Matter Programs in Agriculture, Languages Other Than English, Business, Health Science, Home Economics, and Industrial and Technology Education* and *Handbooks for Teacher Educators and Program Reviewers* in each of the academic areas (1999)

- The *Standards of Program Quality and Effectiveness for the Subject Matter Requirements for the Multiple Subject Teaching Credential* (Sept. 2001)

- The *Standards of Quality and Effectiveness for Preliminary Teacher Preparation Programs* (Sept. 2001, revised 2003)

- The national subject matter standards for agriculture, languages other than English: American Sign Language, business, health science, home economics, and industrial and technology education

- Other important state and national studies and publications relevant to the subject areas.

The State Board-adopted K-12 student academic content standards and/or frameworks were the central documents used by the panels. In 2002, the first phase of subject matter advisory panels had identified six standards contained within the 1992 standards documents that were common to all of the subject matter standards, and had added several additional standards based on the SB 2042 reform (Chap. 578, Stats. 1998). This process resulted in the development and approval by the Commission of ten standards "common to all" programs that were incorporated within the specific program standards for each of the single subject area standards developed in phase three.

The *Subject Matter Requirements for the Multiple Subject Teaching Credential* was also an important document used by the panels. In some cases the multiple subject standards language

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and the organization of the standards along with their required elements were incorporated by the panels. The standards of the national professional organizations also served as a guide and provided a comprehensive perspective for panel members.

b. Field Review of Draft Standards
The single subject matter standards developed by the phase three advisory panels and subsequently adopted by the Commission were formatted to align with the SB 2042 teacher preparation and teacher induction program standards. In this new format the broad conceptual standard is presented, followed by the required elements of the standard which further articulate the concepts contained within the standard. This format contrasts with the structure of the previous subject matter standards, where a "rationale" was provided for each standard followed by "factors to consider" that were suggestions for how a program could meet the standard. In the new format the standard and all of its required elements must be addressed for the standard to be fully met.

Early in 2004 the Commission conducted a field review of the draft single subject matter standards. The draft standards were mailed to all deans of education, directors of teacher education programs, and single subject coordinators at all Commission-accredited four-year institutions in California; to learned societies and professional organizations; and to funded subject matter projects, teacher organizations, school districts, and county offices of education. The draft standards were sent as well to over one hundred selected K-12 public school teachers and college/university professors. The standards were also placed on the Commission's web site with instructions on how to download the standards, complete the field review survey, and return survey responses to the Commission.

Standards review surveys were returned to the Commission by February 2004. Commission staff tallied all responses and listed all comments on a master survey form for each subject matter area. Revisions made by the panels as a result of the field review included providing clarifications and examples, and reorganizing content. Elements that were consistent with the state's K-12 student academic content standards remained unchanged.

c. Adoption of Standards by the Commission
The revised subject matter standards for all of the phase three subject areas were adopted by the Commission at its meeting of September 2006.

B. Alignment of Subject Matter Program Standards and Subject Matter Assessments
The Teacher Preparation and Licensing Act of 1970 (Ryan Act) established the requirement that candidates for teaching credentials verify their knowledge of the subjects they intend to teach. Candidates for single subject teaching credentials may satisfy this subject matter requirement by completing approved single subject matter programs or by passing subject matter examinations that have been adopted by the Commission. Senate Bill 2042 (Chap. 548, Stats.1998) required that subject matter programs and examinations for prospective teachers be aligned with K-12 student standards and frameworks.

To achieve this alignment and congruence, the Commission asked the subject matter advisory panels to develop subject matter requirements (SMRs) that would be consistent in scope and

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content with the K-12 standards and frameworks. At the time the Commission adopted the phase three subject matter program standards in 2006, it also adopted the subject matter requirements appended to the standards document. College and university faculty and administrators are urged to examine these SMRs as a source of information about essential content that should be included in subject matter preparation programs, as these represent the scope of content on which both the program standards and the subject matter examinations are based and to which the program standards and the examinations are aligned.

Early in 2004, the Commission began the process of developing assessments that were aligned with the K-12 requirements. These assessments are known as the "California Subject Examinations for Teachers (CSET)," and are administered by an external contractor under the Commission's direction. In the six subject areas, multiple-choice and constructed-response test items were drafted, based on the subject matter requirements. The test items were reviewed by both the Bias Review Committee and the appropriate subject matter advisory panel and revised as necessary. The CSET examinations for the phase three subject areas of agriculture, business, health science, home economics, industrial and technology education, and languages other than English: American Sign Language were first administered in fall 2005, and these assessments replaced the SSAT and Praxis II examinations in these content areas.

C. Single Subject Teaching Credentials
The Single Subject Teaching Credential authorizes an individual to teach classes in that content area in departmentalized settings. The holders of these credentials may teach at any grade level, but the great majority of the classes in these subjects occurs in grades seven through twelve. The Commission asked the subject matter advisory panels to recommend new policies to ensure that future teachers are prepared to instruct in the subject areas most commonly taught in secondary public schools.

D. Contacting the Commission
The Commission periodically reviews and updates its policies, in part on the basis of responses from colleges, universities, school districts, county offices, professional organizations and individual professionals. The Commission welcomes all comments and questions about the standards and other policies in this handbook. For further information, please contact the Commission at the following address:

Commission on Teacher Credentialing
Professional Services Division
1900 Capitol Avenue
Sacramento, California 95814-4213

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Part 2: Standards of Quality and Effectiveness for the Subject Matter Program in Industrial and Technology Education

A. Overview of the Industrial and Technology Education Standards Handbook

This section of the handbook is organized into three parts. Part 1 of the handbook provides the background and context for the industrial and technology education program standards. Part 2 of the handbook presents the twenty program standards as well as the subject matter requirements for industrial and technology education. Part 3 of the handbook provides information about implementation of the industrial and technology education program standards in California colleges and universities.

1. Contribution of the Industrial and Technology Education Subject Matter Advisory Panel

The Subject Matter Standards and Requirements in Agriculture are designed to provide a basis for instruction and assessment in the content preparation of teacher candidates in agriculture teacher preparation programs. The standards provide the general domains of content preparation, but institutions are encouraged to reference both these standards and the corresponding Subject Matter Requirements on which the standards are based, as provided in this handbook when developing program documents.

This edition of the handbook differs in content and organization from the previous edition. However, the panel incorporated appropriate elements of the previous edition into these new standards. The panel made extensive efforts to align these standards of content knowledge for teachers with California's curriculum requirements for agriculture instruction in grades K-12. The inclusion of both university and K-12 faculty on the panel provided assurance that both education sectors were represented and their needs and interests were addressed. The panel also included a review of the agriculture teacher preparation standards of other states in its deliberations. The panel wishes to thank the substantial number of agriculture education experts who contributed both directly and indirectly to the development of these standards.

Each standard is designed to be comprehensive enough to provide general direction for university programs of agriculture education, yet flexible enough to allow and encourage local enrichment. In many respects the standards are organized by domain, but programs are allowed, and even encouraged, to consider alternative options for organizing the curriculum. As long as all domains and required program elements are included, a program will be determined to have addressed the standards appropriately and may be approved by the Commission after review.

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2. Industrial and Technology Education and the Preparation of Technology Teachers: Introduction by the Advisory Panel

Technology is a constantly evolving body of knowledge that deals with the technical way in which individuals change the world, using critical thinking skills, resources, and devices to solve problems. Research and development of technology outpace the ability of the average person to adopt and apply technological advances. Industrial and technology education (ITE), the study of technology, is concerned as a discipline with learning about technology in its broadest forms. According to the National Academy of Engineering (NAE), "Technology comprises…the process by which humans modify nature to meet their needs and wants." (Pearson & Young, 2002). Technology is the practical application of knowledge to process natural resources. It is innovation and design, where science is inquiry and discovery.

The basis for the ITE subject matter requirements and standards is a core of study that establishes the "nature of technology." This core is surrounded by the content areas of power and energy, information and communication, and project and product development. The common nature of these areas of technology allows prospective teachers to study any content area and understand the basic principles of the other technology content areas. Through thematic organization of the content, prospective teachers study the relationships and principles using different technologies. Further, each of the content areas overlaps with different industry sectors (i.e., engineering and design, building trades and construction, manufacturing and product development, energy and utilities, and transportation).
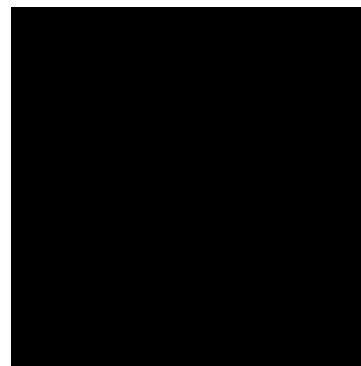
In addition, ITE is the application of many different academic disciplines including mathematics, science, social studies, language arts. The interrelation of these content areas creates a dynamic that demonstrates to students how the world works and how they can participate in it. Preparing future teachers who understand these relationships empowers them to teach the highly diverse areas of ITE. This "central core" structure also anticipates a rapidly changing world in which flexibility is the most critical attribute.

The ability to think creatively, solve problems, apply systems-oriented thinking and analysis, and use appropriate tools in the process represents a fundamental set of skills required of everyone today. An ITE continuum of well-planned, coordinated, articulated, integrated and sequential learning experiences will prepare students for successful transition to higher education, the workplace, and further success in the home and community while pursuing lifelong learning.

Industrial and Technology Education teacher preparation programs should provide prospective teachers with a foundation that facilitates learning and helps students achieve their potential in public school programs concerned with developing technological literacy. The Technology for All Americans Project defined *technological literacy* as "the ability to use, manage, assess, and understand technology" (2000, p. 9). Programs should expect candidates to acquire technical literacy as well as technological literacy. *Technical literacy* is defined as "technical proficiency

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in a specific technological area." Prospective teachers of ITE must be able to use technology skillfully but also understand the impact of its use in the world.

ITE preparation programs should provide opportunities for students to research and assess current and emerging technologies using leadership and team building skills. Programs should model the knowledge, capabilities, "ways of thinking and acting," attitudes and ethics necessary for professional success. Programs must also provide teacher candidates with an understanding of professional organizations and their value in supporting industrial and technology educators. New teachers joining the professional field of Industrial Technology Education must understand the significance of their involvement and participation as leaders in technological literacy.

Our increasing dependency on technology requires that we strive to improve and increase our command of technology. People need more opportunities to develop a fundamental understanding of technology. It is incumbent upon public education to prepare students to be technologically informed, responsible and involved citizens. It is incumbent upon ITE programs to provide prospective teachers with a comprehensive knowledge of the nature of technology.

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Pearson, G. and Young, A. T. (2002). *Technically Speaking: Why All Americans Need to Know More About Technology*. Washington, DC. National Academy Press.

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http://www.iteaconnect.org/TAA/TAA.html

Wright, M., Yates, B., and Scarcella, J. (2003). *Technology Education: Much More Than Computers*. Techniques. Alexandria, VA. Association for Career and Technical Education.

3. Definitions of Key Terms

California state law authorizes the California Commission on Teacher Credentialing to set standards and requirements for preparation programs (Education Code sections 44225a, i, j; 44310; and 44311). The following key terms are used in this handbook.

Preconditions
A precondition is a requirement for initial and continued program approval. Unlike standards, preconditions specify requirements for program compliance, not program quality. Commission staff determines whether a program complies with the adopted preconditions on the basis of a program document provided by the college or university. In the program review sequence, a program that meets all preconditions then undergoes a more intensive review to determine if the program's quality meets the Commission's standards.

Standards
Standards are statements of program quality adopted by the Commission on Teacher Credentialing to describe acceptable levels of quality in programs of subject matter study offered by regionally-accredited colleges and universities that award baccalaureate degrees. Each standard is elaborated by "required elements" for that standard. Programs must meet all of the applicable standards for both initial and continuing approval of a subject matter program by the

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Commission. The Commission determines whether a program satisfies a standard on the basis of an intensive review of all available information provided by the program sponsor related to the standard.

Required Elements

Required elements guide institutions in developing programs that meet the standards, and are also used by program review panels in judging the quality of a program in relation to a given standard. Within the overall scope of a standard, each required element describes how a particular area of the subject matter requirements should be applied within a preparation program. The elements also help programs identify what the Commission believes are the important dimensions of program quality with respect to each standard. In determining whether a program fulfills a given standard, the review panel considers the information provided by the program in response to all of the required elements of that standard. When the review panel finds that a program has met each standard and each of its required elements, the program is then recommended to the Commission for approval.

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B. The Industrial and Technology Education Standards

1. Preconditions for the Approval of Subject Matter Programs in Industrial and Technology Education

To be approved by the Commission, a Subject Matter Program in Industrial and Technology Education must comply with the following preconditions.

(1)   Each Program of Subject Matter Preparation for the Single Subject Teaching Credential in Industrial and Technology Education shall include (a) a minimum of 36 semester units (or 54 quarter units) of core coursework in industrial and technology education and related subjects that are commonly taught in departmentalized classes in California public schools, and (b) a minimum of 9 semester units (or 15 quarter units) of coursework that provides extended study of the subject. These two requirements are elaborated in Preconditions 2 and 3.

(2)   The core (breadth) of the program shall include coursework in (or directly related to) subjects that are commonly taught in departmentalized classes of industrial and technology education and related subjects in the California public schools, including foundations of the nature of technology and introductions to power and energy, information and communication, and project and product development. These subjects should be understood to also include building and construction, manufacturing, engineering and transportation as appropriate.

 (3)   Extended studies in the program (breadth, depth, perspective, concentrations) shall be designed to supplement the core of the program as described in Standard 12.

In addition to describing how a program meets each standard of program quality in this handbook, the program document by an institution shall include the course titles, unit designations, catalog descriptions and syllabi of all courses in the program that are used to meet the standards. Program documents must include a matrix that identifies which courses meet which standards.

Institutions may determine whether the standards and required elements are addressed through one or more courses for each commonly taught subject or courses offering integrated study of these subjects. Institutions may also define the program in terms of required or elective coursework. However, elective options must be equivalent in meeting the standards. Coursework offered by any appropriate department(s) of a regionally accredited institution may satisfy the preconditions and standards in this handbook. Programs may use general education courses in meeting the standards.

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2. Standards of Quality and Effectiveness for the Subject Matter Program in Industrial and Technology Education

a. Standards Common to All Single Subject Matter Preparation Programs

Standard 1: Program Philosophy and Purpose

The subject matter preparation program is based on an explicit statement of program philosophy that expresses its purpose, design, and desired outcomes in relation to the Standards of Quality and Effectiveness for Single Subject Teaching Credential Programs. The program provides the coursework and field experiences necessary to teach the specified subject to all of California's diverse public school population. Subject matter preparation in the program for prospective teachers is academically rigorous and intellectually stimulating. The program curriculum reflects and builds on the State-adopted *Content Standards for California Public Schools K-12* and curriculum frameworks for California public school*s*. The program is designed to establish a strong foundation in and understanding of subject matter knowledge for prospective teachers that provides a basis for continued development during each teacher's professional career. The sponsoring institution assigns high priority to and appropriately supports the program as an essential part of its mission.

Required Elements:

1.1   The program philosophy, design, and intended outcomes are consistent with the content of the State-adopted academic content standards for K-12 students and curriculum frameworks for California public schools.

1.2   The statement of program philosophy shows a clear understanding of the preparation that prospective teachers need in order to be effective in delivering academic content to all students in California schools.

1.3   The program provides prospective teachers with the opportunity to learn and apply significant ideas, structures, methods and core concepts in the specified subject discipline(s) that underlies the 6-12 curriculum.

1.4   The program prepares prospective single-subject teachers to analyze complex discipline-based issues; synthesize information from multiple sources and perspectives; communicate skillfully in oral and written forms; and use appropriate technologies.

1.5   Program outcomes are defined clearly and assessments of prospective teachers and program reviews are appropriately aligned.

1.6   The institution conducts periodic review of the program philosophy, goals, design, and outcomes consistent with the following: campus program assessment timelines, procedures, and policies; ongoing research and thinking in the discipline; nationally accepted content standards and recommendations; and the changing needs of public schools in California.

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Standard 2: Diversity and Equity

The subject matter program provides equitable opportunities for all prospective teachers to learn by utilizing instructional, advisement and curricular practices that insure equal access to program academic content and knowledge of career options. Included in the program are the essential understandings, knowledge and appreciation of the perspectives and contributions by and about diverse groups in the discipline.

Required Elements:

2.1   In accordance with the Education Code Chapter 200 human differences and similarities to be examined in the program include, but are not limited to those of sex, race, ethnicity, socio-economic status, religion, sexual orientation, and exceptionality. The program may also include study of other human similarities and differences.

2.2   The institution recruits and provides information and advice to male and female prospective teachers from diverse backgrounds on requirements for admission to and completion of subject matter programs.

2.3   The curriculum in the Subject Matter Program reflects the perspectives and contributions of   diverse groups from a variety of cultures to the disciplines of study.

2.4   In the subject matter program, classroom practices and instructional materials are designed to provide equitable access to the academic content of the program to prospective teachers from all backgrounds.

2.5   The subject matter program incorporates a wide variety of pedagogical and instructional approaches to academic learning suitable to a diverse population of prospective teachers. Instructional practices and materials used in the program support equitable access for all prospective teachers and take into account current knowledge of cognition and human learning theory.

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Standard 3: Technology

The study and application of current and emerging technologies, with a focus on those used in K-12 schools, for gathering, analyzing, managing, processing, and presenting information is an integral component of each prospective teacher's program study. Prospective teachers are introduced to legal, ethical, and social issues related to technology. The program prepares prospective teachers to meet the current technology requirements for admission to an approved California professional teacher preparation program.

Required Elements:

3.1   The institution provides prospective teachers in the subject matter program access to a wide array of current technology resources. The program faculty selects these technologies on the basis of their effective and appropriate uses in the disciplines of the subject matter program.

3.2   Prospective teachers demonstrate information processing competency, including but not limited to the use of appropriate technologies and tools for research, problem solving, data acquisition and analysis, communications, and presentation.

3.3   In the program, prospective teachers use current and emerging technologies relevant to the disciplines of study to enhance their subject matter knowledge and understanding.

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Standard 4: Literacy

The program of subject matter preparation for prospective Single Subject teachers develops skills in literacy and academic discourse in the academic disciplines of study. Coursework and field experiences in the program include reflective and analytic instructional activities that specifically address the use of language, content and discourse to extend meaning and knowledge about ideas and experiences in the fields or discipline of the subject matter.

Required Elements:

4.1   The program develops prospective teachers' abilities to use academic language, content, and disciplinary thinking in purposeful ways to analyze, synthesize and evaluate experiences and enhance understanding in the discipline.

4.2   The program prepares prospective teachers to understand and use appropriately academic and technical terminology and the research conventions of the disciplines of the subject matter.

4.3   The program provides prospective teachers with opportunities to learn and demonstrate competence in reading, writing, listening, speaking, communicating and reasoning in their fields or discipline of the subject matter.

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Standard 5: Varied Teaching Strategies

In the program, prospective Single Subject teachers participate in a variety of learning experiences that model effective curriculum practices, instructional strategies and assessments that prospective teachers will be expected to use in their own classrooms.

Required Elements:

5.1   Program faculty include in their instruction a variety of curriculum design, classroom organizational strategies, activities, materials and field experiences incorporating observing, recording, analyzing and interpreting content as appropriate to the discipline.

5.2   Program faculty employ a variety of interactive, engaging teaching styles that develop and reinforce skills and concepts through open-ended activities such as direct instruction, discourse, demonstrations, individual and cooperative learning explorations, peer instruction and student-centered discussion.

5.3   Faculty development programs provide tangible support for subject matter faculty to explore and use exemplary and innovative curriculum practices.

5.4   Program faculty use varied and innovative teaching strategies, which provide opportunities for prospective teachers to learn how content is conceived and organized for instruction in a way that fosters conceptual understanding as well as procedural knowledge.

5.5   Program coursework and fieldwork include the examination and use of various kinds of technology that are appropriate to the subject matter discipline.

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Standard 6: Early Field Experiences

The program provides prospective Single Subject teachers with planned, structured field experiences in departmentalized classrooms beginning as early as possible in the subject matter program. These classroom experiences are linked to program coursework and give a breadth of experiences across grade levels and with diverse populations. The early field experience program is planned collaboratively by subject matter faculty, teacher education faculty and representatives from school districts. The institution cooperates with school districts in selecting schools and classrooms for introductory classroom experiences. The program includes a clear process for documenting each prospective teacher's observations and experiences.

Required Elements:

6.1   Introductory experiences shall include one or more of the following activities: planned observations, instruction or tutoring experiences and other school based observations or activities that are appropriate for undergraduate students in a subject matter preparation program.

6.2   Prospective teachers' early field experiences are substantively linked to the content of coursework in the program.

6.3   Fieldwork experiences for all prospective teachers include significant interactions with K-12 students from diverse populations represented in California public schools and cooperation with at least one carefully selected teacher certificated in the discipline of study.

6.4   Prospective teachers will have opportunities to reflect on and analyze their early field experiences in relation to course content. These opportunities may include field experience journals, portfolios, and discussions in the subject matter courses, among others.

6.5   Each prospective teacher is primarily responsible for documenting early field experiences. Documentation is reviewed as part of the program requirements.

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Standard 7: Assessment of Subject Matter Competence

The program uses formative and summative multiple measures to assess the subject matter competence of each candidate. The scope and content of each candidate's assessment is consistent with the content of the subject matter requirements of the program and with institutional standards for program completion.

Required Elements:

7.1   Assessment within the program includes multiple measures such as student performances, presentations, research projects, portfolios, field experience journals, observations, and interviews as well as oral and written examinations based on criteria established by the institution.

7.2   The scope and content of each assessment is congruent with the specifications for the subject matter knowledge and competence as indicated in the content domains of the Commission-adopted subject matter requirement.

7.3   End-of-program summative assessment of subject matter competence includes a defined process that incorporates multiple measures for evaluation of performance.

7.4   Assessment scope, process, and criteria are clearly delineated and made available to students when they begin the program.

7.5   Program faculty regularly evaluate the quality, fairness, and effectiveness of the assessment process, including its consistency with program requirements.

7.6   The institution that sponsors the program determines, establishes and implements a standard of minimum scholarship (such as overall GPA, minimum course grade or other assessments) of program completion for prospective single subject teachers.

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Standard 8: Advisement and Support

The subject matter program includes a system for identifying, advising and retaining prospective Single Subject teachers. This system will comprehensively address the distinct needs and interests of a range of prospective teachers, including resident prospective students, early deciders entering blended programs, groups underrepresented among current teachers, prospective teachers who transfer to the institution, and prospective teachers in career transition.

Required Elements:

8.1   The institution will develop and implement processes for identifying prospective Single Subject teachers and advising them about all program requirements and career options.

8.2   Advisement services will provide prospective teachers with information about their academic progress, including transfer agreements and alternative paths to a teaching credential, and describe the specific qualifications needed for each type of credential, including the teaching assignments it authorizes.

8.3   The subject matter program facilitates the transfer of prospective teachers between post-secondary institutions, including community colleges, through effective outreach and advising and the articulation of courses and requirements. The program sponsor works cooperatively with community colleges to ensure that subject matter coursework at feeder campuses is aligned with the relevant portions of the state-adopted academic *Content Standards for California Public Schools K-12*.

8.4   The institution establishes clear and reasonable criteria and allocates sufficient time and personnel resources to enable qualified personnel to evaluate prospective teachers' previous coursework and/or fieldwork for meeting subject matter requirements.

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Standard 9: Program Review and Evaluation

The institution implements a comprehensive, ongoing system for periodic review of and improvement to the subject matter program. The ongoing system of review and improvement involves university faculty, community college faculty, student candidates and appropriate public schools personnel involved in beginning teacher preparation and induction. Periodic reviews shall be conducted at intervals not exceeding 5 years.

Required Elements:

9.1   Each periodic review includes an examination of program goals, design, curriculum, requirements, and student success, technology uses, advising services, assessment procedures and program outcomes for prospective teachers.

9.2   Each program review examines the quality and effectiveness of collaborative partnerships with secondary schools and community colleges.

9.3   The program uses appropriate methods to collect data to assess the subject matter program's strengths, weaknesses and areas that need improvement. Participants in the review include faculty members, current students, recent graduates, education faculty, employers, and appropriate community college and public school personnel.

9.4   Program improvements are based on the results of periodic reviews, the inclusion and implications of new knowledge about the subject(s) of study, the identified needs of program students and school districts in the region, and curriculum policies of the State of California.

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Standard 10: Coordination

One or more faculty responsible for program planning, implementation and review coordinate the Single Subject Matter Preparation Program. The program sponsor allocates resources to support effective coordination and implementation of all aspects of the program. The coordinator(s) fosters and facilitates ongoing collaboration among academic program faculty, local school personnel, local community colleges and the professional education faculty.

Required Elements:

10.1   A program coordinator will be designated from among the academic program faculty.

10.2   The program coordinator provides opportunities for collaboration by faculty, students, and appropriate public school personnel in the design and development of and revisions to the program, and communicates program goals to the campus community, other academic partners, school districts and the public.

10.3   The institution allocates sufficient time and resources for faculty coordination and staff support for development, implementation and revision of all aspects of the program.

10.4   The program provides opportunities for collaboration on curriculum development among program faculty.

10.5   University and program faculty cooperate with community colleges to coordinate courses and articulate course requirements for prospective teachers to facilitate transfer to a baccalaureate degree-granting institution.

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b. Industrial and Technology Education Program Standards

Standard 11: Core Studies (Breadth)

Core studies in the program will include the nature of technology and develop technological literacy including: problem solving, engineering, design, technological models and systems, workplace competencies, and their interaction. The program also provides foundations in power and energy, information and communication, and project and product development. The program course work emphasizes the appropriate integration of academics, requiring higher order thinking skills to solve problems in practical situations. The program addresses issues of safety, environmental concerns and societal impact. The program includes career and employability skills in industry and education that promote appropriate attitudes for occupational success (i.e., legal and ethical responsibility, accountability and adaptability, leadership and teamwork).

Required Elements:

11.1   The program introduces candidates to the structures of K-12 career pathways (building trades and construction, energy and utilities, engineering, manufacturing and product development, transportation) in industrial and technology education.

11.2   The program will provide a broad overview of career clusters, training options, work place dynamics, and employability skills (Secretary's Commission on Achieving Necessary Skills: SCANS).

11.3   The program provides candidates with varied experiences in using the engineering design process and knowledge of the product life cycle and new and emerging technologies to arrive at solutions.

11.4   The program will provide candidates with multiple and varied experiences in project and product development that focus on demonstration of innovation and design skills.

11.5   Through project development the candidate will demonstrate their understanding of factors that influence design form and function.

11.6   The program requires candidates to identify and apply correct health and safety procedures and regulations to insure safe and proper selection, uses, maintenance and repair of tools, equipment and systems.

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11.7   The program demonstrates how to assess safe and proper use of equipment in the laboratory environment.

11.8   The program will provide experiences in planning, design, and management of safe laboratory facilities, including environmental concerns.

11.9   Programs will require candidates to develop an understanding of the evolution of technology and the influence of industry and technology on history.

11.10 Candidates will be required to identify and analyze the resources and controls needed to develop and understand how systems interact.

11.11 Through project-based experiences, a candidate will demonstrate an understanding of project and product management.

11.12 The course work in the program integrates other appropriate academic disciplines (e.g., mathematics, science, humanities) with Industrial and Technology Education and draws substantive connections for students.

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Standard 12: Extended Studies

The program includes coursework to supplement the program core and further prepare prospective teachers in the range of subjects included in the state-adopted K-12 curriculum. Prospective teachers build upon foundational knowledge acquired in the program core by further work within or across the content domains. The program's design for extended studies provides prospective teachers with options, including both specialized and comprehensive preparation based on coherent patterns of coursework.

Required Elements:

12.1   The program offers extended studies that ensure that prospective teachers deepen their knowledge within or across content domains.

12.2   Extended study may be offered in any or all of the following patterns:

   a.   A combination of related content areas across one or more of these three domains: power and energy, information and communication, and project and product development.

   b.   Concentrations in one or more domains

   c.   Concentration in any content area within a domain (e.g., transportation, aeronautics, automotive repair)

12.3   The program provides advising for prospective teachers to select or develop a coherent pattern of extended study based on a well-defined goal (i.e., to meet requirements of the major; to complement or supplement studies in the program core; to pursue special professional interests, e.g., engineering technology, manufacturing, multi-media).

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Standard 13: Power and Energy

The program of study will include the fundamental scientific concepts specific to power and energy with applications to mechanical, fluid, thermal, and electrical systems. The program incorporates relevant K-12 state curriculum standards into coursework and lab experiences. The program requires candidates to design, maintain and analyze a variety of power, energy, and transportation systems.

Required Elements:

13.1   Coursework will teach candidates to utilize scientific principles of physics, chemistry and mathematics to solve problems and apply technological solutions to situations involving work, power, energy, and efficiency.

13.2   The program will provide experiences in power generation, storage processes, systems management, and alternative sources.

13.3   The program will provide instruction and experiences in power and energy safety, control, transmission, loads, and conversion systems.

13.4   The program will deliver instruction in the design, development, and maintenance of transportation systems and infrastructures.

13.5   The program will teach the appropriate selection and use of a variety of materials and renewable and non-renewable resources used in power and energy systems that consider environmental and consumer issues.

13.6   Candidates will develop hands-on skills with a variety of current power and energy tools and equipment.

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Standard 14: Information and Communication

The program will provide advanced course work in the fields related to information and communication technology. Course work will include information, design processes, systems, and resources. The program incorporates relevant K-12 state curriculum standards. Candidates demonstrate an understanding of the knowledge and skills needed to design, analyze, use, and maintain a variety of communication systems. Course work will provide technological content in conjunction with societal, ethical, moral and economic considerations.

Required Elements:

14.1   The course work will enable the candidate to conceptualize, design, document, prototype and refine the design of products, projects and systems.

14.2   The course work will enable the candidate to analyze, understand and apply knowledge of various ways of communicating (e.g., imaging technologies, graphics, telecommunications, broadcast, information and multimedia systems).

14.3   Candidates will appropriately select and effectively use materials, tools, equipment in information and communication systems and subsystems.

14.4   Candidates will be able to apply principles of security procedures to define physical and electronic security plans.

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Standard 15: Project and Product Development

The program will prepare candidates to use project and product design processes appropriate to industrial and technology education. Candidates will incorporate engineering principles, manufacturing and construction processes, resources, statistical data, and quality assurances as they relate to the universal system model (input, processes, output, feedback). The program incorporates the relevant K-12 state curriculum standards. Candidates analyze ethical, moral, and environmental issues in project and product design.

Required Elements:

15.1   The candidate is required to use engineering principles through project development, using a variety of academic concepts and technical procedures in a lab environment, to manufacture a product safely.

15.2   Candidates will understand manual and automated manufacturing and construction processes by learning how to construct and/or maintain projects or products using plans and following regulatory codes and industry guidelines.

15.3   Candidates will demonstrate an understanding of cost, estimation, supply chain and demand dynamics.

15.4   Candidates will understand research and development concepts as they relate to operation management, including cost estimation, design prototyping, material selection, and timeline.

15.5   Candidates will demonstrate knowledge and capabilities for safe and proper use of tools, equipment, and materials.

15.6   Candidates will understand principles and procedures of product testing and design, customer feedback, industry standards (e.g., ANSI, ISO), total quality management (TQM), and change management (e.g., change orders, version control).

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c. Subject Matter Requirements for Prospective Teachers of Industrial and Technology Education

(1.) Introduction
Subject matter requirements represent the body of knowledge, skills and abilities expected of teachers of Industrial and Technology Education in the public schools. The subject matter requirements form the basis for both program standards and examination specifications for Industrial and Technology Education.

(2.) Content Domains for Subject Matter Knowledge and Skills in Industrial and Technology Education

Domain 1.   Nature of Technology
Candidates understand technology as a problem-solving process and know the history and evolution of technology. They understand that technology involves creativity and innovation and are able to use concepts from the core content areas of science, mathematics, social science, and language arts as well as other content areas commonly taught in California public schools to design solutions to problems. Candidates understand the social aspect of technology and analyze the positive and negative effects of technologies on society and the environment. They understand the skills, knowledge, attitudes, and commitment to lifelong learning necessary to develop technological literacy and apply this knowledge in a rapidly changing global environment.

1.1   Innovation and Design
a. Demonstrate an understanding of the engineering design process (e.g., defining a problem, using research techniques, communicating solutions, analyzing and optimizing solutions).
b. Understand the product life cycle (e.g., prototypes, transition to production, evaluating product success).
c. Demonstrate an understanding of how to use technological processes and systems to arrive at solutions to real-world problems.
d. Demonstrate an understanding of current technological methods and processes to meet the needs of new and emerging fields and technologies (e.g., robotics, artificial intelligence, biotechnology, nanotechnology).
e. Demonstrate an understanding of factors that influence design form (e.g., color theory, layout, aesthetics, juxtaposition, dimension).
f. Demonstrate an understanding of factors that influence design function (e.g., purpose, practicality, ergonomics, utility).

1.2   Careers and Employability Skills
a. Demonstrate an understanding of industrial and technology career opportunities (including postsecondary opportunities) and career paths.
b. Understand skills, knowledge, responsibilities, attitudes, and aptitudes associated with industrial and technology careers.
c. Demonstrate an understanding of workplace dynamics and structures (e.g., teaming, development of interpersonal and leadership skills, human resource and human

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efficiency development, Secretary's Commission on Achieving Necessary Skills [SCANS]).

1.3   Safety and the Environment
   a. Demonstrate an understanding of health and safety procedures needed for laboratory and workplace settings.
   b. Understand the safe and proper use and maintenance of tools and equipment.
   c. Demonstrate an understanding of safety regulations (e.g., OSHA regulations) and procedures (e.g., use of MSDS, handling of hazardous waste), including emergency procedures.
   d. Demonstrate an understanding of the safe design and management of laboratory facilities and planning of safe laboratory activities.
   e. Demonstrate an understanding of environmental issues (e.g., water pollution, air pollution, noise pollution, health hazards) associated with the development and use of technology and technological systems (i.e., power and energy, communication and information, manufacturing, and construction).
   f. Understand procedures and techniques for selecting, maintaining, and repairing technological systems to ensure a safe environment.

1.4   Society and Globalization
   a. Understand the history and evolution of technology.
   b. Identify and analyze the positive and negative influences of technology on communities and society (e.g., air pollution, land use, environmental impact).
   c. Analyze factors (e.g., cultural, economic) that influence innovation and the development of technology.
   d. Demonstrate an understanding of the relationship between technological literacy and technical skills.
   e. Demonstrate an understanding of legal and ethical issues related to technology (e.g., copyright, liability, intellectual property, patents).

1.5   Independent and Integrated System Model
   a. Demonstrate an understanding of systems and subsystems in terms of input, process, output, and feedback.
   b. Identify and analyze the resources needed to develop and support technological systems.
   c. Demonstrate an understanding of control systems and their use in technological systems.
   d. Demonstrate an understanding of project and product management.

1.6   Integration with Other Academic Disciplines
   a. Use appropriate mathematical concepts (e.g., algebra, trigonometry, statistics, geometry) to analyze data and solve problems.
   b. Use a variety of communication skills (e.g., technical writing, schematics, flowcharts, verbal communication) to convey information.
   c. Use appropriate scientific concepts (e.g., Newton's laws, ideal gas law, chemical reactions) to analyze and solve problems.

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d. Demonstrate an understanding of the interactions between technology and the humanities, culture, and political sciences.

Domain 2.   Power and Energy

Candidates demonstrate an understanding of the fundamental scientific concepts of power and energy and how these concepts apply to mechanical, fluid, thermal, and electrical systems. Candidates understand the generation, transmission, storage, and control of power and energy and apply this knowledge to design, maintain, and analyze a variety of power and energy technologies, including transportation technologies.

2.1   Processes
   a. Demonstrate an understanding of power generation processes (e.g., geothermal, nuclear, solar, fossil fuel, fuel cell).
   b. Apply scientific principles of work, power, energy, and efficiency to analyze energy transformations.
   c. Demonstrate an understanding of processes for energy storage (e.g., dams, flywheels, batteries).
   d. Solve problems using mathematical concepts related to power and energy (e.g., Ohm's law, Pascal's law, moment of inertia, time, distance, velocity).
   e. Apply concepts of power and energy to analyze a variety of technological systems (e.g., mechanical, fluid, electrical, thermal).

2.2   Systems
   a. Understand safety principles, safety regulations, and safety engineering.
   b. Describe and analyze systems that convert energy from one form to another (e.g., engines, generators, actuators).
   c. Describe components and analyze characteristics of power control systems (e.g., brakes, valves, switches, circuit breakers).
   d. Understand power transmission systems (e.g., gears, cams, parallel and series circuits, pulleys, pumps).
   e. Demonstrate knowledge of the architecture and infrastructure associated with land, sea, aerospace, and intermodal transportation systems (e.g., rapid transit, shipping lanes, highways, locks, flight patterns).

2.3   Resources
   a. Demonstrate an understanding of renewable (e.g., solar, wind, biomass) and nonrenewable (e.g., fossil, nuclear, chemical) energy sources.
   b. Demonstrate an understanding of the uses and properties of materials (e.g., fuels, lubricants, conductors).
   c. Demonstrate an understanding of a variety of power and energy tools and equipment (e.g., multimeter, torque wrench, dynamometer).

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Domain 3.   Information and Communication

Candidates demonstrate an understanding of the knowledge and skills needed to design, analyze, use, and maintain a variety of communication systems. They demonstrate an understanding of how information systems encode, transmit, receive, decode, and store data. Candidates understand principles of graphic communication and use appropriate graphic tools to communicate visually. They apply knowledge of circuits and their components to electronic communication systems.

3.1   Design Processes
   a. Demonstrate an understanding of design documentation (e.g., blueprints, mock-ups, storyboards, schematics).
   b. Apply practical design concepts (i.e., form and function) to solve problems in communication.
   c. Understand computer design (e.g., hardware, software).
   d. Demonstrate an understanding of drawing and drafting principles (e.g., lettering, multiview drawing, dimensioning).

3.2   Systems
   a. Apply knowledge of imaging and image production (e.g., photographic, electronic, print).
   b. Analyze characteristics of telecommunication systems.
   c. Analyze characteristics of broadcast communication systems.
   d. Understand processes (e.g., preproduction, production, distribution) for developing multimedia systems.

3.3   Resources
   a. Demonstrate an understanding of the materials (e.g., media, electronic components), tools (e.g., test equipment, software, hand tools), and equipment (e.g., hardware, imaging equipment) used in information and communication systems.
   b. Understand strategies for the effective use of information resources (e.g., data banks, subject matter experts, search engines).
   c. Demonstrate an understanding of communication systems architecture and infrastructure (e.g., analog systems, digital systems, mainframes, client servers, network architecture).
   d. Understand criteria for the selection of appropriate materials, tools, and equipment used in information and communication systems.

3.4   Security and Privacy
   a. Understand physical security systems (e.g., locks, access control, motion detectors, surveillance, intrusion detection).
   b. Understand electronic security systems (e.g., access and permissions, passwords, user IDs, roles of administrators and end users, encryption).
   c. Demonstrate an understanding of principles related to security compliance procedures (e.g., personal responsibility, job function, need-to-know basis, ethical and legal).

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Domain 4.   Project and Product Development

Candidates demonstrate an understanding of product development and how to plan, manage, and produce manufacturing and construction systems. Candidates understand the resources and processes needed to safely use a variety of processes to design, produce, maintain, and evaluate products. Candidates demonstrate an understanding of the requirements and constraints in the engineering design process and the systems approach to manufacturing and construction enterprises. Candidates understand issues associated with quality management and quality control, including statistical tools.

4.1   Engineering Principles
   a. Understand the project and product design process (e.g., needs assessment, product analysis, prototyping, production design, design for manufacturing).
   b. Understand safety principles, safety regulations, and safety engineering.
   c. Understand a variety of mathematical concepts and applications (e.g., measurement, tolerance, financial calculations) for product development.
   d. Understand principles of data collection, communication, and analysis (e.g., sampling, graphical representations, statistical measures).

4.2   Manufacturing and Construction Processes
   a. Understand processes involved in manufacturing (e.g., casting, forming, shaping, finishing, assembling, packaging).
   b. Understand project (e.g., building trades, multimedia, transportation) construction processes.
   c. Understand manufacturing and construction codes, regulations, and industry guidelines (e.g., OSHA, zoning, building codes, Environmental Impact Reports).
   d. Understand the role of research and development in manufacturing and construction enterprises.
   e. Understand operations management (e.g., cost estimation, decision making, capacity planning).

4.3   Resources
   a. Demonstrate an understanding of the proper identification, selection, use, and maintenance of tools and equipment (e.g., hand tools, power tools, measurement instruments).
   b. Demonstrate an understanding of the identification, selection, and use of materials (e.g., wood, metals, plastics, composites, polymers).
   c. Demonstrate an understanding of the supply chain and its components (e.g., vendors, just-in-time).

4.4   Quality Assurance
   a. Understand principles and procedures of product testing (e.g., source, in-process, final inspection).
   b. Demonstrate an understanding of strategies for obtaining and responding to customer feedback.
   c. Demonstrate knowledge of the development and purpose of industry standards such as Institute of Electrical and Electronics Engineers (IEEE), International Organization

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for Standardization (ISO), and American National Standards Institute (ANSI).
    d. Understand the principles of total quality management (TQM).
    e. Identify principles and strategies of change management (e.g., software version numbers, building codes, change orders).

(3.) Subject Matter Abilities Applicable to the Content Domains in Industrial and Technology Education

Candidates demonstrate an understanding of the nature of technology and of the core technological concepts that remain constant as technological progress accelerates. Candidates understand the design process as a problem-solving model and are able to use it to solve problems in industrial and technology education. They apply core academic knowledge of industrial and technology education, including science, mathematics, measurement, economics, and data analysis to investigate and design technological systems and processes. Candidates are able to effectively communicate designed solutions using a variety of technologies and propose strategies for implementing the solutions. They understand how to use the tools, machines, resources, and processes needed to turn ideas into workable solutions. In addition, candidates understand and apply safety rules and practices in the classroom, laboratory, and workplace.

Candidates have knowledge of historical events, current research, and recent developments in technology and industry. Candidates have knowledge of interactions between technology and society (cultural, social, economic, and environmental) in which technologies are used. They demonstrate an understanding of the importance of continued education (e.g., professional organizations, technical publications, industry, research and development) for staying current with technological innovations. They are able to work with industry representatives and community organizations to identify industry trends and job opportunities, employers' expectations, and the personal characteristics (e.g., appropriate work habits, social and communication skills) necessary for obtaining and maintaining employment in industry and technology. They demonstrate an understanding of career planning and development and student leadership opportunities, along with the skills and attitudes needed for developing successful careers in industry and technology. Candidates are aware of the characteristics, functions, and structures of student leadership organizations, clubs, and competitive groups (e.g., SkillsUSA®, Technology Student Association (TSA)) and the candidates' roles and responsibilities as advisors.

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Part 3: Implementation of Standards of Quality and Effectiveness for Subject Matter Programs in Industrial and Technology Education

A. Standards Implementation Process

The 2006 *Standards of Quality and Effectiveness for Subject Matter Programs in Industrial and Technology Education* are part of a broad shift in Commission policies related to the preparation of professional teachers and other California educators resulting from the mandate of Senate Bill 2042 (Chap 548, Stats. 1998). This policy change insures high quality in educator preparation while at the same time providing for flexibility along with accountability for institutions that offer programs for prospective teachers. The success of this reform effort depends on the effective implementation of program quality standards for each credential.

1. Process for Cyclical Review and Improvement of Subject Matter Standards

The Commission will adhere to its established cycle of review and reconsideration of the *Standards of Quality and Effectiveness for Subject Matter Programs in Industrial and Technology Education* as well as in other subjects. The standards will be reviewed and reconsidered in relation to changes in academic disciplines, state-adopted K-12 student academic content standards, school curricula, and the backgrounds and needs of California K-12 students. Reviews of program standards will be based on the advice of subject matter teachers, college and university faculty, and curriculum specialists. All program documents will be reviewed by statewide teams of peer reviewers selected from among qualified K–12 and postsecondary professional educators. Prior to each review, the Commission will invite interested individuals and organizations to participate in the review process.

2. Process for Adoption and Implementation of Standards

Program sponsors have at least two years to transition from the current to the new subject matter program standards. Program documents should be submitted at the sponsor's earliest convenience to avoid a potential lapse in program approval status. Expiration dates of currently approved single subject matter programs are provided below. Each single subject matter program for single subject credentials must be submitted for review and approval in accordance with the new standards. No new programs written to the previous standards were allowed to be submitted to the Commission for approval following the September 2006 adoption of the new phase III standards.

Information about transition timelines for candidates, sunset and expiration dates for currently approved programs, and preconditions are provided by the Commission through Coded Correspondence to the field and by additional program transition documents as appropriate to the needs of the field. Program sponsors should check the Commission website (www.ctc.ca.gov) frequently for updates.

3. Transition and Implementation Timelines for Programs

a. Program Transition Timeline

By July 1, 2008, existing ("old") programs based on previous subject matter standards should be superseded by new Commission-approved programs that have met the new standards. Once a program based on the new standards receives Commission approval, all students not previously

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enrolled in the old program (i.e., all "new" students) should enroll in the new program. After June 30, 2008, no "new" students should enroll in an "old" program, even if a new Commission-approved program in the subject is not available at that institution. Students who enrolled in an old program prior to July 1, 2008, may continue to complete the old program until July 1, 2012.

b. Program Implementation Timeline

September 2006	Commission adoption of new subject matter program standards. No new subject matter programs in industrial and technology education will be accepted for review in relation to the Commission's previous set of standards.
January 2007	The Commission initiates ongoing technical assistance for developing new subject matter programs to meet the new standards.
March 2007	The Commission initiates ongoing training for Program Reviewers. Qualified subject matter experts are prepared to review programs in relation to the standards.
March 2007	Review and approval of programs under the new standards begin.
2007-09	Institutions submit programs for review on an ongoing basis. Once a "new" program is approved, all students who were not previously enrolled in the "old" program (i.e., all new students) must enroll in the new program. Students may complete an old program if they enrolled in that program either (1) prior to the commencement of the new program at their campus, or (2) prior to July 1, 2008, whichever occurs first.
July 1, 2008	"Old" programs that are based on the previous 1998 standards must be superseded by new programs that have obtained Commission approval. After June 30, 2008, no new students may enroll in an old program, even if a new program is not yet available at the institution.
2007-12	The Commission continues to review program applications submitted in response to the standards and preconditions provided in this handbook. Programs submitting an application for review should provide the Commission with two qualified nominees who can serve as reviewers of other institutions' program applications in order to expedite the review process.
July 1, 2012	This is the final date for candidates to complete subject matter preparation programs approved under the previous 1998 standards. To qualify for a credential based on an "old" program, students must have completed that program prior to either (1) the implementation of a new program with full or interim approval at their institution, or (2) July 1, 2012, whichever occurs first.

c. Implementation Timelines for Candidates

Based on the Commission's implementation plan, candidates for Single Subject Credentials in Industrial and Technology Education who do not plan to pass the subject matter examinations

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adopted by the Commission should enroll in subject matter programs that meet the Commission's 2006 standards either (1) once a new program commences at their institution, or (2) before July 1, 2008, whichever occurs first. After a new program begins at an institution, no students may enroll for the first time in an "old" program (i.e. one approved under the previous set of standards). Regardless of the date when new programs are implemented, no students should enter old programs after June 30, 2008.

Candidates who enrolled in programs approved on the basis of prior standards ("old" programs) may complete those programs provided that (1) they entered the old programs either before new programs were available at their institutions, or before July 1, 2008, and (2) they complete the old programs before July 1, 2012. Candidates who do not comply with these timelines may qualify for Single Subject Teaching Credentials by passing the subject matter examinations that have been adopted for that purpose by the Commission.

4. Technical Assistance for Program Sponsors

Commission staff offers technical assistance for developing new programs and documents upon request by the sponsor of a preparation program. Program sponsors who are writing to new standards are advised to schedule a technical assistance meeting with staff at the earliest possible time. Topics of information at technical assistance meetings include:

- Explanation of the implementation plan adopted by the Commission
- Description of the steps in program review and approval
- Review of program standards, required elements and preconditions, as well as examples of implementing the standards
- Opportunities to discuss subject-specific questions
- Guidance on appropriate responses to the standards and the necessary level of supporting documentation and evidence to be provided within the responses
- Format and organization of the program document

5. Process for Review and Approval of Program Documents Submitted to the Commission

A regionally accredited institution of postsecondary education that would like to offer (or continue to offer) a subject matter preparation program for the Single Subject Credential in Industrial and Technology Education may present a program application that responds to the preconditions and the standards provided in this handbook. The submission of programs for review and approval is voluntary for colleges and universities.

If an institution would like to offer two or more distinct programs of subject matter preparation in industrial and technology education with different emphases, a separate application may be forwarded to the Commission for each program. However, the Commission encourages institutions to coordinate its single subject programs that are within the same subject matter discipline in order to maximize resources.

Programs may be submitted after January 2007 on an ongoing basis. Review of subject matter program proposals began in March 2007 and continues on an ongoing basis.

a. Selection, Composition and Training of Program Document Review Panels

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Review panel members are selected because of their subject matter expertise and their knowledge of curriculum and instruction in the public schools of California. Reviewers are selected from institutions of higher education, school districts, county offices of education, organizations of subject matter experts, and statewide professional organizations. Because the review process consists of a professional peer review, the Commission needs those institutions seeking program review and approval to provide at least two qualified nominees to participate in the review process. Members of the Commission's former Single Subject Waiver Panels and Subject Matter Advisory Panels also may be selected to serve as program reviewers.

The Commission staff conducts training and calibration that all reviewers must attend.   Training includes explanations of:
- the purpose and function of subject matter preparation programs
- the Commission's legal responsibilities in program review and approval
- the role of reviewers in making program determinations
- the role of the Commission's professional staff in assisting reviewers
- the analysis and discussion of each standard and its required elements
- alternative ways in which a standard could be met
- the aspects of the review process
- how to provide responsive feedback for program revision

Reviewers are also provided with simulated practice and calibration exercises in preparation for their roles in reviewing programs.

b. Steps in the Review of Programs
The Commission is committed to conducting a program review process that is objective and comprehensive. The agency also seeks to be as helpful as possible to colleges and universities throughout the review process. Commission staff is available to consult with program sponsors during program document development.

The review process consists of two sequential steps, as outlined below. An institution responding to the Commission's standards will respond to the two sets of standards described earlier in this handboo*k,* namely, the Preconditions and the Program Standards (including Common Standards and discipline-specific Program Standards)*.*

Step One: Review of Preconditions. An institution's response to the preconditions is reviewed by the Commission's professional staff since the preconditions are based on Commission policies and do not involve issues of program quality. The Preconditions are reviewed upon receipt of the institution's formal document submission. Once the responses to the Preconditions are deemed to have met these standards, the program document's responses to the Program Standards are then referred to the expert reviewers.

Step Two: Review of Program Standards. Unlike the Preconditions, the Program Standards (i.e., Common Standards and discipline-specific Program Standards) address issues of program quality and effectiveness. The Commission's process, therefore, is to have each institution's response to the Program Standards reviewed by a small team of subject matter experts (i.e., peer review).   Once the review team determines that a proposed program meets the Program

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Standards, Commission staff recommends the program for approval by the Commission at its next public meeting.

If an institution's response to either the Preconditions or the Program Standards is determined to not meet the standards, feedback is formally provided to the program sponsor with an explanation of the review findings that includes specific reasons for the determination that the program standards are not met. During this aspect of the review process, program sponsors can obtain further information and assistance from Commission staff.

The Commission intends the overall program review process to be as helpful as possible to colleges and universities. Because a large number of institutions prepare teachers in California, it is very helpful for program sponsors to first consult with the Commission's professional staff regarding program applications that are in preparation. During the Program Standards review process, however, program sponsors and/or their representatives should not contact members of a review team directly under any circumstances in order to preserve the objectivity and integrity of the review process. If during the review process a program sponsor needs additional information, the program sponsor or representative should inform the designated staff consultant. If the issue or question is not resolved in a timely manner, program sponsors may contact the Executive Director of the Commission. After considering the review feedback, the program sponsor may make appropriate changes to the program document and resubmit the program application to the designated Commission staff member for reconsideration by the review team.

If, however, feedback from the review process indicates that only minor or technical changes need to made in a program application in order to meet the applicable standards, Commission staff rather than the peer review team will review the resubmitted document and, if the standards are determined to have been met, will submit the program application to the Commission for approval without further review by the peer review team.

Appeal of an Adverse Decision. An institution that would like to appeal a decision of the staff (regarding Preconditions) or the review team (regarding Program Standards) may do so by submitting the appeal to the Executive Director of the Commission. The institution should include the following information in the appeal:

- The original program document and the stated reasons of the Commission's staff or the review team for not recommending approval of the program.

- A specific response by the institution to the initial denial, including a copy of the resubmitted document (if it has been resubmitted).

- A rationale for the appeal by the institution.

The CTC Executive Director may deny the appeal, appoint an independent review panel, or present the appeal directly to the Commission for consideration.

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B. Submission Guidelines for Single Subject Matter Program Documents

To facilitate the proposal review and approval process, Commission staff has developed the following instructions for program sponsors submitting documents for approval of Single Subject Matter Programs. It is essential that these instructions be followed accurately. Failure to comply with these procedures can result in a proposal being returned to the prospective program sponsor for reformatting and/or revision prior to being forwarded to program reviewers.

1. Transmittal Instructions

Sponsoring agencies are required to submit **three printed copies in binders** of their proposal(s), to the following address:

California Commission on Teacher Credentialing
Professional Services Division: Single Subject Matter Programs
1900 Capitol Avenue
Sacramento, CA 95814

In addition, **one CD ROM copy of the proposal text** (including supporting evidence where possible) should be submitted. This electronic submission should be in Microsoft Word, or a Microsoft Word compatible format. Some phases of the review process will involve secure web-based editing. To facilitate this process, please leave no spaces in the name of your document, and be sure that the name of the file ends in ".doc" (example: CTCdocument.doc).

2. Organization of Required Documents

Sponsoring agencies should include as the cover page of each copy of the program application the "Sponsoring Organization Transmittal Cover Sheet." A copy of the Transmittal Cover Sheet is located at the end of this section of the handbook for use by program sponsors. One set of the proposal application documents should contain the original signatures of the program contacts and chief executive officer, and the remaining three copies may contain photocopies of the original signatures.

The program contact identified on the Transmittal Cover Sheet will be the individual who is informed electronically and by mail as changes occur, and to whom the review feedback will be sent. Program sponsors are strongly urged to consult the CTC web site, www.ctc.ca.gov, for updates relating to the implementation of new single subject matter standards and programs.

Each proposal must be organized in the following order:

- Transmittal Cover Sheet
- Table of Contents
- Responses to Preconditions, including course lists, units and descriptions
- Responses to each Common Standard and each Program Standard, including all Required Elements

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The response to the standards must:

- include evidence (i.e., syllabi, course materials, program data, etc.) supporting the responses to the standards. The evidence sections should be tabbed and labeled in order to assist the reviewers in finding the appropriate supporting documentation (e.g., course numbers, document names, etc.) The supporting evidence should also be cross-referenced within the response.
- provide numbering on each page, preferably in the footer

3. Developing Responses to the Standards

a. Responses to the Common Standards.
The Commission adopted 10 standards that relate to program design and structure for programs in *all* single subject disciplines.

Standard 1   Program Philosophy and Purpose
Standard 2   Diversity and Equity
Standard 3   Technology
Standard 4   Literacy
Standard 5   Varied Teaching Strategies
Standard 6   Early Field Experiences
Standard 7   Assessment of Subject Matter Competence
Standard 8   Advisement and Support
Standard 9   Program Review and Evaluation
Standard 10   Coordination

An institution's program application should include a subject-specific reply to each of the Common Standards, 1 through 10. Program sponsors may choose to submit a separate response to the Common Standards developed individually for each of the subject matter content areas contained in the program application. As an alternative to this approach, however, a program sponsor may choose instead to submit a more generic response to the ten Common Standards.

In a "generic response," the program sponsor would describe how credential preparation programs in all subjects will meet the ten standards, if the information is the same across all of the subject matter content areas contained in the program application. A "generic response" should include sufficient information to enable an interdisciplinary panel of reviewers to determine that the ten Common Standards are met for each subject area for which approval is requested. If a program sponsor submits a generic response to the Common Standards and that response is deemed to meet the standards, the program sponsor would not have to subsequently include a separate response to the Common Standards for any subject area that had been included in the generic response.

Regardless of the approach to the Common Standards selected by the program sponsor, there are certain institutional mechanisms that could nonetheless be common to all subject matter programs. For example, the type and/or level of institutional support for academic programs, as referenced in the Common Standards for technology or diversity and equity. could apply to all of the sponsor's subject matter programs. At the same time, however, both of these standards (and

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many others) also require a measure of subject-specific program information in order to provide a complete picture to the reviewers.

b. Responses to the Program Standards
Program proposals should provide sufficient information about how the program intends to deliver content consistent with each standard so that a knowledgeable team of professionals can determine whether each standard has been met by the program. The goal in writing the response to any standard should be to describe the proposed program clearly enough for an outside reader to understand what a prospective teacher will experience, as he or she progresses through the program in terms of depth, breadth, and sequencing of instructional and field experiences, and what he or she will know and be able to do and demonstrate at the end of the program. Review teams will then be able to assess the responses for consistency with the standard, completeness of the response, and quality of the supporting evidence.

The written text should be organized in the same order as the standards, including the required elements. Responses should not merely reiterate the standard. They should demonstrate how the standard will be met by describing both the content and processes that will be used to implement the program and by providing evidence to support the explanation. The written text may be organized in a variety of ways. Both holistic and element-by-element responses, as well as a combination of these approaches, are acceptable. Whatever the organizational format, the text must reference all required elements, or address them specifically. ***Responses that do not address each standard and its required elements will be considered incomplete***.

Lines of appropriate supporting evidence will vary with each standard. Some examples of supporting evidence helpful for review teams include:

- Charts and graphic organizers to illustrate program organization and design
- Descriptions of faculty qualifications, including vitae for full time faculty
- Course or module outlines or showing the sequence of course topics, classroom activities, materials and texts used, and out-of-class assignments
- Specific descriptions of assignments and other formative assessments that demonstrate how prospective teachers will reinforce and extend key concepts and/or demonstrate an ability or competence
- Documentation of materials to be used, including tables of contents of textbooks and identification of assignments from the texts, and citations for other reading assignments.
- Current catalog descriptions.

4.   Packaging a Submission for Shipment to the Commission

Please **do not**:

- Use foam peanuts as packaging material
- Overstuff the binders. Use more binders if necessary. No binders larger than 3 inches will be accepted.
- Overstuff the boxes in which the binders are packed, as these may break open in shipment.

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- **Date:** _____

- **Sponsoring Institution**:_____

- Submission Type(s) Place a check mark in the appropriate box.

Agriculture Subject Matter Program	
American Sign Language Subject Matter Program	
Business Subject Matter Program	
Health Science Subject Matter Program	
Home Economics Subject Matter Program	
Industrial and Technology Education Subject Matter Program	

- Program Contacts:

    1.   Name

_____

Title_____
_

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Address_____

_

_____

_

    Phone   _____Fax

_____

    E-mail _____

Phase II Single Subject Matter Program Sponsor
Transmittal Cover Sheet
(Page 2 0f 2)

    Name

_____

Title_____

Address_____

_

_____

_

    Phone   _____Fax

_____

     E-mail_____

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Chief Executive Officer *(President or Provost; Superintendent):*

Name_____

Address_____
_

_____
__

Phone   _____Fax
_____

E-
mail_____

I Hereby Signify My Approval to Transmit This Program Document to the California Commission on Teacher Credentialing:

CEO   Signature
_____

Title
_____
____

Date_____
_____

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